

MADROÑO

A WEST AMERICAN JOURNAL OF
BOTANY

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Contents

THE IDENTITY AND DELIMITATION OF <i>ALLIUM TOLMIEI</i> BAKER, <i>Marion Owenbey</i>	233
NOTES ON THE GENUS <i>TOWNSENDIA</i> IN WESTERN NORTH AMERICA, <i>Charles B. Heiser, Jr.</i>	238
SOME PARALLELS BETWEEN DESERT AND ALPINE FLORA IN CALIFORNIA, <i>F. W. Went</i>	241
SOME ADDITIONAL NOTES ON POLEMONIACEAE, <i>Herbert L. Mason</i>	249
A NEW SPECIES OF <i>PHACELIA</i> FROM SONORA, MEXICO, <i>Lincoln Constance</i> ...	255
CHROMOSOME NUMBER PUBLICATION, <i>J. A. Rattenbury</i>	257
INDEX TO VOLUME IX	259

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THE IDENTITY AND DELIMITATION OF ALLIUM
TOLMIEI BAKER

MARION OWNBEY

Biosystematic understanding of any group of species is a long-time undertaking during the course of which many minor studies must be made. These are of little consequence in themselves, but *in toto* they are indispensable to the accuracy and acceptability of the final conclusions. One series of such minor studies is concerned with the establishment of the taxonomic identity of each of the proposed names within the group. Others deal with the genetic, cytological, ecological, distributional, and phylogenetic relationships of the biological entities themselves. The results of these minor studies are usually incorporated into the final treatment where each takes up at most only a few lines, and are not scattered through the literature in separate papers. Occasionally, it may be advisable to present the conclusions from such a study in advance of the appearance of the final treatment. The identity of *Allium Tolmiei* seems to be such a case. The recent proposal of two superfluous names for this species (Traub, 1947) calls for a clarification of its identity in accord with the established principles of plant classification.

Allium Tolmiei generally has been accepted for the last seventy years as a valid species of the northwestern states (Watson, 1879; Coulter, 1885; Howell, 1902; Piper, 1906; Rydberg, 1917; Abrams, 1923; Peck, 1941), but there has not been similar unanimity as to the characteristics of the species to which the name should be applied. In the writer's opinion, all of these descriptions were drawn for the most part from specimens which he would refer to *A. Tolmiei*. In other words there has been unanimity in the acceptance of the name, but not in the delimitation of the species which must bear it.

The history of *Allium Tolmiei* in the literature precedes by many years the first appearance of the binomial. In his "Flora Boreali-Americana," Hooker (1839) mentions an unnamed variety β of *A. Douglasii*, with leaves longer than the scape, collected in the "Snake Country" allegedly by Tolmie. Whether or not these specimens were actually collected by Tolmie or by a friend, as he expressly states according to Piper (1906), is not relevant to the problem. In the following discussion, they will be referred to as Tolmie's specimens. The "Snake Country" would undoubtedly be in southwestern Idaho or adjacent Oregon whence come more recent collections closely resembling Tolmie's.

The binomial, *Allium Tolmiei*, was first proposed in 1876 by Baker, who undoubtedly had examined critically Tolmie's specimens preserved at Kew and arrived at the conclusion that they

represented a species distinct from *A. Douglasii*. Unfortunately, he did not describe his new species at that time, but merely cited Hooker's earlier reference to the collection. Thus the name might have remained a *nomen subnudum* had not it been taken up three years later by Watson (1879) and provided with a clear and unmistakable description. With this first adequate description, Watson cites: (1) Tolmie's specimens; (2) Hooker's figure of *A. Douglasii* (in part), about which he undoubtedly was confused; and (3) his own collection from Parley's Park in the Wasatch Mountains, Utah, which he had identified earlier as *A. tribracteatum*, but which now proves to be *A. Brandegei*. As far as can be ascertained, Watson's description was drawn entirely from Tolmie's specimens which are still preserved in an identifiable condition in the Gray Herbarium. He does not mention, for instance, the characteristic cellular reticulations on the bulb coats of *A. Brandegei* which he clearly illustrates in fig. 7 of Plate XXXVIII of the Botany of the King Expedition. It is necessary, then, in the typification of *A. Tolmiei*, to exclude both elements 2 and 3, above. This leaves *A. Tolmiei* Baker ex Watson (1879) exactly equivalent to *A. Tolmiei* Baker (1876) and *A. Douglasii* var. β Hooker (1839), these all being based on the same collection. It is probable that the first adequate description of the species which he attributes to Baker was actually drawn by Watson himself from the specimens preserved in the Gray Herbarium. It seems proper, therefore, to designate this sheet as the type rather than that presumably preserved at Kew.

Six years following the publication of Watson's description of *Allium Tolmiei*, Coulter (1885) accepted this species in his "Manual of the Botany of the Rocky Mountain Region." His description was compiled directly, word for word, from Watson, with certain rearrangements and deletions. Certainly, there is no basis for the assumption that this author had any first-hand knowledge of the species whatsoever, or that this description applies to any species other than that represented by Tolmie's specimens. This would be unimportant had Traub (1947) not made *Allium Tolmiei* Baker the basis of a new varietal combination under *A. Douglasii*, and *A. Tolmiei* "Coulter . . . non Baker" the basis of a new name. From the foregoing, it is clear that *A. Douglasii* var. β = *A. Tolmiei* Baker = *A. Tolmiei* Baker ex Watson = *A. Tolmiei* Baker ex Coulter, these being based on one and the same collection and that *A. Douglasii* var. *Tolmiei* (Baker) Traub and *A. idahoense* Traub, being equal to the same thing are equal to each other, and are accordingly superfluous synonyms of *A. Tolmiei*.

Once the taxonomic identity of a proposed name is established, the next step is the association of this name with a natural biological population. The methods developed by modern systematists for the association of a name with the proper biological entity differ materially from those used by their predecessors.

It is a well-known truism that no two individuals, in the ultimate analysis, are exactly alike. One cannot, therefore, restrict the application of a name to individuals which are exactly like the original ones and arrive at anything which could be called a useful classification. Classical systematy was essentially a mechanical sorting process whereby individuals were associated with extreme morphological forms deemed to represent species—usually on the basis of very slender evidence. That such species frequently coincided with natural units can be attributed to the nature of the material rather than to the reliability of the method. The modern emphasis is on the species as a natural biological phenomenon, whereas, the stress formerly was on actual or supposed specific differences. Modern species are bounded by discontinuities; classic species were marked by distinguishing morphological characters. The two are not the same. The aim of the old systematics was to provide each species with a name and a description. That of the new systematics is to understand the species and to name it only after the need for a name has been clearly established. Indeed, the modern systematist would prefer to arrive at his conclusions apart from and uninfluenced by pre-existing concepts. This is the only way in which he may be sure of avoiding the pitfalls inherent in the older method. *Allium Tolmiei* is a case in point.

Sporadically scattered over much of eastern Oregon and overlapping into adjacent states, there is a series of closely related local populations of the genus *Allium*. In a given locality, the plants are usually very much alike, although they may show some evident variation. In another locality, perhaps close at hand, they may be slightly different or even very different. The plants from locality to locality vary greatly in size, in the relative and absolute length, breadth, curvature, and glaucescence of the leaves, in the relative and absolute length, breadth, and thickness of the scape, whether this structure is slightly, moderately, or strongly flattened, wingless, narrowly or broadly winged, in the number of flowers in the umbel, and the relative and absolute lengths and thicknesses of the flowering pedicels, in the color of the perianth, and even in the intimate details of the floral structure, such as the presence or absence of crests on the ovary, and their development from obsolete to obscure to prominent. The total variation is enormous. Confronted by a half dozen specimens representing as many extremes, no person unacquainted with the complexities of intraspecific variation would question for a moment that each represented a distinct and definite species. If he had fifty of them at once, he might become suspicious, and consider them that anathema of the systematist, the polymorphic species. In all probability, however, he would pick out some three or four of the most conspicuously distinct and aberrant

types, and group the others around these, disregarding the fact that most of them could go into one pile as well as another. These departures from his type concept, he would attribute vaguely to ecological factors.

Modern experimental taxonomy provides a method of investigating such perplexing variation between natural populations. Some thirty collections from as many localities representing the above series have been assembled and grown side-by-side at Pullman under essentially uniform conditions. The distinctive characteristics which marked the parental populations are maintained in the garden. From herbarium studies, it can be inferred that only a small percentage of the local races within the series are represented in this living collection. There is no reason to suppose that within the series there is a single morphological hiatus which cannot be bridged or detoured through intermediate biological populations. Within the same area, however, and extending beyond it to the north and the south, is another series of similar populations, the *A. parvum* series, apparently distinguished at all times by a constant hiatus, the magnitude of which is much less than that of the difference separating any two of a number of extreme populations of either series. This is illustrative of the fact that the magnitude of a difference does not in itself make a species.

The thirty collections of the first series have been studied morphologically and cytologically, and the results of these studies form the basis of a paper in preparation (Ownbey and Aase, unpublished). It is sufficient to say here that Dr. Aase has found most of the local races of the series to be diploid, but that in one limited area, there exist, sometimes side-by-side, morphologically distinguishable diploid and tetraploid races, and that in another, the plants apparently are uniformly hexaploid. The tetraploid race is morphologically nearly indistinguishable from a diploid race growing in a nearby area. No diploid exactly corresponding to the hexaploid race is known, but the attenuated morphological characteristics by means of which it may be recognized are of exactly the same nature and are much less conspicuous than those which distinguish many of the diploid races. Thus it may be concluded that the entire series of intergrading populations represents only a single biological species for which a name must now be selected.

With specimens representing three different local populations of the above species at hand, Watson (1879) proposed, in the same paper, three species, *Allium Cusickii*, *A. pleianthum*, and *A. Tolmiei*, into which pigeon holes subsequent botanists have been vainly struggling to make their specimens fit. Later, Jones (1902) added *A. anceps* var. *aberrans*, and Tidestrom (1916) described the tetraploid as *A. platyphyllum*. Both of these were

promptly reduced to synonymy. Other later proposals probably belonging here have been made, but their identity has not been unequivocally established. The International Rules do not recognize priority of position, but give the subsequent author the privilege of choosing between them should two or more simultaneous proposals prove synonymous. Ordinarily, he picks the one in the prior position (*A. Cusickii*), but in this instance another choice seems imperative. There will always be those who consider Hooker's three Latin words an adequate botanical description, and date the effective publication of *A. Tolmiei* from 1876 instead of 1879, in spite of the fact that these three words describe equally well any one of at least half of the western American species of the genus. To avoid this confusion, the name selected must be the last in the series, *Allium Tolmiei*.

The established synonymy follows:

I. TYPONYMS¹

Allium Tolmiei Baker ex Watson in Proc. Am. Acad. Arts and Sci. 14: 234. 1879, excluding references to illustration of *A. Douglasii* and Watson's collection from Parley's Park; Coulter, Man. Bot. Rocky Mountain Reg., p. 349. 1885; Howell, Fl. N. W. America, p. 642. 1902; Piper in Contr. U. S. Nat. Herb. 11 [Fl. Wash.]: 188. 1906, excluding specimens cited; Rydberg, Fl. Rocky Mountains and Adj. Plains, p. 161. 1917; Abrams, Illust. Fl. Pacific States 1: 387. 1923; Peck, Man. Higher Plants Oregon, p. 195. 1941.

Allium Douglasii var. β . Hooker, Fl. Bor.-Am. 2: 185. 1839.

Allium Tolmiei Baker in Bot. Mag. Ser. III. 32: under t. 6227. 1876, *nomen subnudum*.

Allium Douglasii var. *Tolmiei* (Baker) Traub in Herbertia 12 (1945): 68. 1947.

Allium idahoense Traub, *Ibid.*, p. 69.

II. METONYMS

Allium Cusickii Watson in Proc. Am. Acad. Arts and Sci. 14: 228. 1879; Howell, Fl. N. W. America, p. 642. 1902; Rydberg, Fl. Rocky Mts. and Adj. Plains, p. 161. 1917; Abrams, Illus. Fl. Pacific States 1: 387. 1923; St. John, Fl. S. E. Wash. and Adj. Idaho, p. 85. 1937; Peck, Man. Higher Plants Oregon, p. 195. 1941.

Allium pleianthum Watson in Proc. Am. Acad. Arts and Sci. 14: 233. 1879; Howell, Fl. N. W. America, p. 642. 1902; Rydberg, Fl. Rocky Mts. and Adj. Plains, p. 161. 1917; Abrams,

¹ The terms "typonym" (a name based on the same type) and "metonym" (a name based on another member of the same group), defined in the "Code of Botanical Nomenclature," proposed in Bull. Torrey Bot. Club 31: 249-290. 1904, have not been generally adopted. They represent exceedingly useful concepts.

Illus. Fl. Pacific States 1: 386. 1923; Peck, Man. Higher Plants Oregon, p. 195. 1941.

Allium anceps var. *aberrans* Jones, Contr. West. Bot. No. 10, p. 10, fig. 9. 1902.

Allium platyphyllum Tidestrom in Torreyia 16: 242. 1916.

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NOTES ON THE GENUS *TOWNSENDIA* IN WESTERN NORTH AMERICA

CHARLES B. HEISER, JR.

While identifying the Compositae collected by Miss Annie M. Alexander and Miss Louise Kellogg in the Sweetwater Mountains of California and Nevada during the summer of 1945, I encountered a number of specimens of *Townsendia*. An investigation of herbarium material of the genus was undertaken, and since field studies seem out of the question at present, I am recording here some of my results.

In the revision of the genus by Larsen (1927), nineteen species are recognized for the genus. Larsen lists only two species, *Townsendia scapigera* and *T. Watsoni*, as occurring in the states of California and Nevada. The last few years have witnessed increasing collecting activity in the Great Basin area and additional material has been obtained so that seven species are now known to occur in these states.

Since the publication of Larsen's paper, two new species have been described, *T. minima* Eastwood (1936) from Utah and *T. diversa* Osterhout (1928) from Colorado. The description of another new species in the present paper brings the total number of species recognized to twenty-two, some of which doubtfully deserve specific rank.

All of the specimens cited are deposited in the Herbarium of the University of California, Berkeley, unless otherwise indicated. During the course of this study, material has been examined from the California Academy of Science (CA), the Missouri Botanical Garden (MBG), the Dudley Herbarium of Stanford University, the United States National Herbarium, the Intermountain Herbarium of Utah State Agricultural College (IH), and the Rocky Mountain Herbarium of Wyoming University. I would like to thank the curators of these herbaria for the privilege of examining their specimens.

Townsendia sericea has been collected in both California (Mono County: Maguire & Holmgren 26109; Duran 1661) and Nevada (Nye County: Maguire & Holmgren 25818, 25944). *Townsendia incana* is known from Nevada from a specimen collected by

Shockley (103) in Nye County, and has recently been reported from Lincoln County by Barneby (1947). *Townsendia arizonica* has been collected several times in Clark County, Nevada, chiefly in the Charleston Mountains (Alexander 774, 780; Alexander & Kellogg 1558, 1568, 1676; Clokey 7772, 7773; Ripley & Barneby 2910).

Townsendia spathulata is known from high altitudes at three localities in Mono County, California (Duran 1662, Maguire & Holmgren 26109a, Alexander & Kellogg 4061). Alexander and Kellogg have noted that the single plant of this species which they collected was growing with *T. scapigera*. The Maguire and Holmgren specimen is only a fragment mounted on a sheet with *T. sericea*.

Townsendia florifer has been collected several times in Nevada: [Elko County: May 10, 1942, Cantelow s. n. (CA); Ripley & Barneby 4613 (CA); Maguire & Holmgren 2828; Holmgren & Lund 3 (IH). White Pine County: Ripley & Barneby 3596 (CA)]. *Townsendia Watsonii* was reported from Nevada by Larsen on the basis of a specimen collected in 1891 by A. J. Jones, without definite locality. This entity, however, is scarcely specifically distinct from *T. florifer*.

One of the most interesting species in the genus, *T. scapigera*, was known in California from only one collection at the time of Larsen's revision, and was not known from Nevada at that time. It is now known for several stations in both states. Only one collector is cited for each county. [CALIFORNIA. Inyo County: Alexander & Kellogg 2492, 2993, 3020, 3036. Mono County: Alexander & Kellogg 3959, 4053, 4556, 4556A, 4561. Modoc County: May 1879, Lemmon s. n. NEVADA. Elko County: Holmgren 1034, 00245 (IH). Esmeralda County: Maguire & Holmgren 25640. Mineral County: Alexander & Kellogg 4440. Nye County: Train 2738. White Pine County: May 1918, King s. n. (CA). Eureka-Lander counties: Eastwood & Howell 168, 175 (CA)].

Townsendia scapigera is an extremely variable species, and the forms found in Inyo and Mono counties deserve special mention. In Inyo County, dwarf forms occur which have rays 7–11 mm. long, heads 11–13 mm. high, and 12–22 involucre bracts (Alexander & Kellogg 3036, 3020, 2993). The plants from the Sweetwater Mountains (Alexander & Kellogg 4556, 4556A, 4053, 3959), on the other hand, are large, with rays 14–16 mm. long, heads 15–20 mm. high, and 30–37 involucre bracts. Examination of the pollen of the latter specimens revealed a high percentage of empty grains, as well as the presence of both 3- and 4-pored grains similar to those found in many apomictic species. It would not appear wise to give formal taxonomic recognition to these entities until further studies can be undertaken.

During the summers of 1946 and 1947 I had the privilege of

examining the specimens of *Townsendia* in the herbarium of the Missouri Botanical Garden. Of particular interest were the specimens collected by von Schrenk in Wyoming which Larsen in her revision interpreted as *T. scapigera*. These specimens do not fall within the range of any known species of the genus and accordingly are described as new.

Townsendia anomala sp. nov. Herba perennis ad 4 cm. alta, foliis spathulatis usque 1 cm. longis 3 mm. latis dense strigillosis, capitulis in ramis foliaceis brevi-pedunculatis, involucri bracteis lanceolatis acuminatis, marginibus membranaceis latis, pappis plurisetosis, setis disciflorum ca. 5 mm. longis, ligulis ca. 4 mm. longis, achaeniis 3-4 mm. longis leviter pubescentibus, pilis brevibus crassis, plerumque simplicibus aliquando emarginatis vel brevibidentatis.

Perennial up to 4 cm. in height; leaves spathulate, 1 cm. or less long, 3 mm. or less wide, densely strigillose; heads on leafy branches, short pedunculate; involucre 2-3 seriate, 6-8 mm. wide; bracts of the involucre lanceolate, acuminate with wide membranaceous margins; rays about 15, 5-7 mm. long, about 1 mm. wide; pappus plurisetose, the setae of the disk-flowers slightly longer than that of the ray-flowers; achenes 3-4 mm. long, lightly pubescent with short, thick, mostly simple or sometimes emarginate or short-bidentate hairs.

Specimens examined. Wyoming. Park County: dry ridge, Howell Ranch, August 26, 1922, *H. von Schrenk s. n.* (type, herbarium of the Missouri Botanical Garden, no. 901271); Holm Lodge, about 40 miles west of Cody, August 27, 1922, *H. von Schrenk s. n.* (MBG).

The Howell Ranch, on which Holm Lodge is located, is ten miles east of the east entrance of Yellowstone Park at an altitude of approximately 7000 feet.

The new species appears to be more closely related to *T. spathulata* than to *T. scapigera*, and is found in the range of the former species. *Townsendia spathulata* occurs at altitudes of from 8000 to 12000 feet. *Townsendia anomala* is rather readily distinguished from it by the pubescence of the leaves and the much smaller heads which are borne on short leafy branches rather than being sessile. The hairs of the achenes of both species are more or less similar. Larsen describes the hairs of the achenes of *T. spathulata* as bidentate, but as has been pointed out by Hitchcock and Thompson (1945) the hairs may be simple in this species.

A number of problems in the genus *Townsendia* call for extensive field work and experimental studies. The majority of the species recognized at present are rather clearcut over most of their range, but this distinction is frequently blurred at the boundaries. For example, *T. strigosa* is a rather well defined entity throughout the southern part of its range, but in Wyoming this species appears to approach *T. florifer*. Whether hybridization or

some other factor is responsible can only be revealed by future studies.

Townsendia, for the most part, is confined to rather high altitudes in the Rocky Mountains. From my preliminary survey of the genus it is apparent that certain mountain ranges possess distinctive races or species. A critical correlation of the geographical distribution and morphological variation in the genus should reveal the effects of isolation and the origin of new forms or species.

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SOME PARALLELS BETWEEN DESERT AND ALPINE FLORA IN CALIFORNIA

F. W. WENT

At first sight it may seem that a desert flora is the opposite of an alpine flora, just as the climatic conditions seem so different. The alpine flora is usually largely influenced by the long cold winters, whereas the desert flora derives its specific character from the hot summers and lack of water.

A comparison will be made between the flora of the central and southern Sierra Nevada (Yosemite and Sequoia National parks) and the Mohave and Colorado deserts of California. In and around these deserts several mountain ranges reach into the alpine zone so that a continuous range of climatic conditions links the two chosen areas; for comparison, however, the extremes will be discussed: montane and alpine conditions at 2000 meters and higher, the desert conditions below 1000 meters.

The alpine climate is one of a very short growing season of about two months duration (July and August) at altitudes of 3000 meters (Clausen, Keck, and Hiesey, 1940) and a little longer at 2500 meters. Due to the relatively small precipitation, snow cover is in most localities not the limiting factor determining the beginning and end of the growing season. Only towards the end of June do the mean minimal daily temperatures reach values near 0° C.; before that the freezing point is reached every night, which

makes growth for most plants impossible. Melting snowbanks indicate how few plants can develop at all temperatures around the freezing point. *Erythronium*, *Caltha biflora* and some *Carex* species are examples of plants which can grow to a very limited extent under melting snow, which means at 0° C., but most other plants covered by snow (such as *Salix*) do not start to show visible signs of growth until the snow has disappeared. Since in most plants actual growth occurs during night, no appreciable growth is possible until the night temperatures remain above the freezing point. And in the beginning of September the nights become too cold again for growth. Day temperatures during the growing season become quite high (20 to 25° C.). Precipitation is very limited during the growing season, usually not exceeding 40 mm. during the growing period, and is irregularly distributed as thunderstorms. Therefore the plants have to depend on soil moisture, which restricts their distribution. Also it increases the percentage of xerophytic plant types compared with the moister alpine regions of the mountains farther north. Yet the main limitation of growth is due to low temperatures.

In the lower deserts of southern California the rainfall occurs almost exclusively during the winter, when temperatures are fairly low; at sea level freezes occur only seldom, but, at altitudes around 1000 meters, growth during the winter months is suspended due to low temperatures. Then a short growing season (March through May) follows before the soil is too dry for further plant development.

Therefore the desert and alpine climates have in common a very short growing season: in the desert it is limited by cold in the beginning and by moisture in the end, and under alpine conditions it is limited by cold both as far as beginning and end are concerned, dryness also entering in as a factor. During the growing season in both localities a high rate of insolation and extremes in daily range of temperature are common, especially low night temperatures. Considering all this it is not amazing that marked parallels in vegetation occur.

Whereas at least one-half of the California alpine plants belong to genera migrating from the north (*Achillea*, *Aquilegia*, *Androsace*, *Antennaria*, *Carex*, various conifers, *Draba*, *Epilobium*, *Pedicularis*, *Potentilla*, *Primula*, *Ranunculus*, *Saxifraga*, *Silene*, *Tofieldia* and *Viola*), a considerable number developed from typically Western North American genera. In general the latter genera have a much wider distribution over California than those coming from the north. In Table 1 the approximate altitudinal distribution of the circumboreal and Western North American genera is shown. Most of the data are taken from Jepson's Manual (1925) with occasional additions and changes based on personal observations. In general the altitudinal range for most species is higher in the southern Sierra Nevada than indicated by Jepson.

TABLE 1. APPROXIMATE ALTITUDINAL DISTRIBUTION OF CIRCUMBOREAL AND WESTERN NORTH AMERICAN GENERA

Genera with circumboreal distribution	No. of California species total	Main distribution above 2000 m.	Per cent alpine species	Genera with main distribution in Western America	No. of California species total	Main distribution above 2000 m.	Per cent alpine species
<i>Anemone</i>	5	3	60	<i>Brodiaea</i>	21	3	12
<i>Antennaria</i> . .	8	8	100	<i>Calochortus</i> . .	24	4	17
<i>Arenaria</i> . . .	14	7	50	<i>Ceanothus</i> . . .	29	5	17
<i>Arnica</i>	10	7	70	<i>Collinsia</i> . . .	17	7	41
<i>Carex</i>	127	58	46	<i>Delphinium</i> . .	16	5	31
<i>Crepis</i>	8	4	50	<i>Eriogonum</i> . . .	32	15	47
<i>Draba</i>	12	9	75	<i>Eriophyllum</i> . .	66	18	27
<i>Epilobium</i> . .	13	10	77	<i>Gilia</i>	13	4	31
<i>Hieracium</i> . .	7	3	43	<i>Mimulus</i>	19	6	31
<i>Pedicularis</i> .	6	5	83	<i>Monardella</i> . . .	39	12	31
<i>Pirola</i>	6	4	67	<i>Penstemon</i> . . .	19	5	26
<i>Potentilla</i> . .	44	30	68	<i>Phacelia</i>	37	20	54
<i>Salix</i>	22	12	54	<i>Ribes</i>	55	11	20
<i>Saxifraga</i> . .	10	8	80	<i>Solidago</i>	26	10	38
<i>Silene</i>	21	10	48	<i>Streptanthus</i> . .	8	2	25
<i>Stellaria</i> . . .	8	4	50		21	7	33
			64%				30%
Mean	20.1	11.4	57%		27.6	8.4	30%

This table shows what was to be expected: the genera migrating from the north have remained in the cooler regions, and relatively few species have adapted themselves to the lower and warmer regions of California. Many of those occurring at lower altitudes are directly derived from or are identical with forms occurring elsewhere at lower altitudes (*Arenaria*, *Carex*, *Crepis*, *Hieracium*, *Salix*, *Silene*, *Stellaria*). Others occur at lower altitudes only in the cool, moist northwestern part of California.

The endemic genera on the other hand have developed everywhere, and have representatives not only in the mountains, but also in chaparral, deserts and valleys. Therefore the percentage of their occurrence in the mountains is lower. However, another factor enters into the problem, and this is moisture. Most of the northern genera require a fairly high amount of moisture, at least in the soil, during the growing season. The species of these genera which have invaded the lower regions usually occur in moist places, thus having acquired only the ability to grow at higher temperatures without having altered their water requirements.

In contrast with the origin in the north of about 50 per cent of the entire alpine flora, when we consider the annuals alone occurring at an altitude of 2700 meters and higher, 75 per cent of them belong to endemic genera. Only the species belonging to circumboreal genera have a distribution reaching beyond Cali-

fornia as far north as Washington and Alaska, as the following list shows. There are more annual species known which reach up into the alpine zone, but most of these belong to the genera listed below (Table 2). Some others, like *Gnaphalium purpureum* and *G. palustre*, have a much lower distribution, and under exceptional conditions are found in the alpine zone.

TABLE 2. DISTRIBUTION OF SPECIES CONSIDERED

Species	Distribution
1. <i>Collinsia parviflora</i>	Mount Shasta to Mount San Jacinto
2. <i>Collinsia Torreyi</i>	Mount Shasta to southern California
3. <i>Cryptantha Torreyana</i>	Mount Shasta to Sequoia National Park
4. <i>Eriogonum spergulinum</i>	Sierra Nevada
5. <i>Gayophytum humile</i>	Washington to southern California
6. <i>Gayophytum ramosissimum</i>	Mount Shasta to southern California
7. <i>Gilia leptalea</i>	Northern California to Sequoia National Park
8. <i>Linanthus ciliatus</i>	
var. <i>neglectus</i>	Southern Sierra Nevada
9. <i>Linanthus Harknessii</i>	Idaho to Yosemite National Park
10. <i>Mimulus leptaleus</i>	Mount Lassen to Sequoia National Park
11. <i>Mimulus montioides</i>	Northwestern Nevada to Sequoia National Park
12. <i>Mimulus rubellus</i>	British Columbia to southern California
13. <i>Nemophila spatulata</i>	Western Nevada to southern California
14. <i>Streptanthus tortuosus</i>	Mount Shasta to Sequoia National Park
15. <i>Draba stenoloba</i>	Alaska to Sequoia National Park
16. <i>Galium bifolium</i>	Washington to Yosemite National Park
17. <i>Juncus triformis</i>	Washington to southern California
18. <i>Polygonum Kelloggii</i>	British Columbia to southern California
19. <i>Polygonum minimum</i>	Alaska to Yosemite National Park

In the Swiss Alps six to thirteen annual plants occur above 2500 meters. Since 2500 meters in the Alps corresponds climatically with 3500 meters in the Sierra Nevada,¹ where almost no annuals are found at 3500 meters (only occasionally some *Mimulus* species, Sharsmith communication), the population of alpine annuals in the Sierra Nevada is relatively poor. This is obviously connected with the limited and unreliable precipitation during summer, which does not favor the development of annuals. It is significant, however, that the annuals occurring are predominantly representatives of endemic Western American species. In the Olympic Mountains of Washington only one single annual (*Polygonum minimum*) is found above timberline. Table 3 gives a comparison of the number of annuals found at corresponding altitudes in Europe (taken from Raunkiaer, 1908) and the Sierra Nevada.

¹ Timberline in the Alps is 2200 meters at the highest, but in general it is around 2000 meters, whereas timberline in the southern Sierra Nevada lies as high as 3100-3300 meters.

TABLE 3. COMPARISON OF THE NUMBER OF ANNUALS FOUND AT DIFFERENT ALTITUDES IN EUROPE AND THE SIERRA NEVADA

Altitude in respect to timberline	Poschiavo	Tatra	Western Alps	Aosta Valley	Sierra Nevada
+ 700 m. - higher	1		3	5	
+ 350 m. - + 700 m.	8	1	13	6	
timberline - + 350 m.	22	9			
- 350 m. - timberline	30	28			19
- 700 m. - 350 m.	39				

From these considerations we can draw an interesting conclusion. The climatic response of a genus or even a family is a physiological character which is extremely tenacious, and can hardly be changed by evolution. Temperature tolerance, drought resistance, water requirements all seem to be physiological characters, which are as constant and as unalterable as generic or family characters, and are not of the type which are usually encountered in genetic variability. Thus most alpine annuals in the southern Sierra Nevada are really desert annuals with a higher altitudinal distribution. The following list shows how many of the alpine annuals of endemic genera have close relatives in desert regions (Table 4). *Nemophila* is a genus of moist places, but closely related genera (*Ellisia*, *Phacelia*) have many desert annual species. *Gayophytum* is an exclusively montane genus, but with many desert species in related genera (*Oenothera*, *Gaura*).

Apart from the relations between desert and alpine therophytes, there are many parallels between perennial plants, shrubs and trees in desert and alpine habitat. These are all basically conditioned by the short growing season with limited moisture, high insolation and large temperature fluctuations. A partial list of plants occurring in both habitats follows:

A. Geophytes (bulbous plants): *Calochortus*, *Brodiaea*.

B. Phanerophytes (trees). At the extreme range it is in both conditions conifers which dominate. *Pinus monophylla* and *Juniperus* are the first trees to appear at the upper range of the desert steppe, where rainfall becomes slightly greater. *Pinus albicaulis*, *P. flexilis*, *Juniperus occidentalis*, *Tsuga Mertensiana* and some other conifers are the last trees found above 3000 meters.

The Joshua tree (*Yucca brevifolia*) has no counterpart in the Sierra Nevada and a large number of moisture-loving shrubs of the alpine habitat have no relatives or analogs in the desert. But in any case the number of deciduous trees and shrubs is small in both habitats.

C. Hemicryptophytes and Chamaephytes. In both habitats we commonly encounter the rosette habit, which has developed into the cushion habit under alpine conditions, but is common as

TABLE 4. ALPINE ANNUALS OF ENDEMIC GENERA HAVING CLOSE RELATIVES IN DESERT REGIONS

Alpine species	Altitudinal range		Desert species	Altitudinal range
<i>Collinsia parviflora</i>	1500-2500	meters	<i>Collinsia Davidsonii</i>	1000 meters
<i>Collinsia Torreyi</i>	1000-3000	"		
<i>Cryptantha glomeriflora</i>	2000-3000	"	<i>Cryptantha angustifolia</i>	0-1500 "
<i>Eriogonum spergulinum</i>	2000-3000	"	<i>Eriogonum gracilimum</i>	0-1500 "
			<i>Eriogonum inflatum</i>	0-1500 "
<i>Gilia capillaris</i>	2000-2500	"	<i>Gilia latifolia</i>	0-1500 "
<i>Gilia leptalea</i>	500-3000	"	<i>Gilia filiformis</i>	500-1500 "
			<i>Gilia ochroleuca</i>	500-1500 "
<i>Linanthus ciliatus</i>	2000-3000	"	<i>Linanthus maculatus</i>	0-1000 "
<i>Linanthus oblanceolatus</i>	2500-3000	"	<i>Linanthus Paryae</i>	500-2000 "
<i>Linanthus Harknessii</i>	1500-3000	"	<i>Linanthus Bigelovii</i>	500-1500 "
<i>Mimulus leptaleus</i>	2000-2500	"	<i>Mimulus Bigelovii</i>	0-2000 "
<i>Mimulus montioides</i>	2000-3500	"	<i>Mimulus mohavensis</i>	500-1000 "
<i>Mimulus rubellus</i>	2000-3000	"		
<i>Streptanthus tortuosus</i>	2000-3000	"	<i>Streptanthus inflatus</i>	500-1000 "

regular rosettes in the desert. Probably both the cushion and rosette habit have the same basic evolutionary significance: 1) low night temperatures counteract stem elongation without interfering too much with organ initiation, 2) during the short growing season no material is squandered on synthesis of stem material, 3) it gives snow and grazing protection.

D. Typical of both alpine meadows and deserts is the mass flowering, in deserts in April and in alpine meadows towards the end of July. This is probably also associated with the short growing season, which forces all plants to flower at approximately the same time, to have a chance to ripen their seed before cold or drought cuts short further development.

E. Table 5 lists closely related perennial species which occur in deserts and under alpine conditions. In this list occur a few plants which are represented by annual species in the desert (e.g. *Calyptridium monandrum*) but by perennial species in the alpine region (*C. umbellatum*).

If we analyze Table 5 together with the list of alpine annuals (Table 2) the following general distribution of these genera over

the world is found:

Cosmopolitan (occurring on more than two continents)	13
North and South America	8
Northern Hemisphere	4
General North America	2
Western North America only	13

This shows clearly how important the evolutionary pressure favors the endemic genera, in developing both desert and mountain forms. Actually the percentage of genera with strong endemism is much greater, since many plants (e.g. *Lupinus*, *Astragalus*) listed under cosmopolitan or other headings, have a strong endemic development in Western North America.

In general it seems more common for a desert plant to develop an alpine relative than for alpine plants to develop forms which

TABLE 5. GENERA WITH REPRESENTATIVES BOTH IN DESERTS AND MOUNTAINS, ARRANGED ACCORDING TO FAMILIES

Family	Alpine species	Desert species
Filices	<i>Pellaea Bridgesii</i> <i>Cheilanthes gracillima</i>	<i>P. ornithopus</i> <i>C. Covillei</i>
Gymnospermae	<i>Pinus contorta</i> <i>Juniperus occidentalis</i>	<i>P. monophylla</i> <i>J. californica</i>
Gramineae	<i>Muhlenbergia andina</i> <i>Sporobolus confusus</i> <i>Oryzopsis Kingii</i> <i>Stipa minor</i>	<i>M. Porteri</i> <i>S. airoides</i> <i>O. hymenoides</i> <i>S. speciosa</i>
Liliaceae	<i>Brodiaea gracilis</i> <i>Calochortus Leichtlinii</i>	<i>B. capitata</i> <i>C. Kennedyi</i>
Polygonaceae	<i>Eriogonum incanum</i>	<i>E. Heermannii</i>
Portulacaceae	<i>Calyptridium umbellatum</i>	<i>C. monandrum</i>
Cruciferae	<i>Streptanthus tortuosus</i>	<i>S. inflatus</i>
Leguminosae	<i>Lupinus superbus</i> <i>Lotus oblongifolius</i> <i>Astragalus Hookerianus</i>	<i>L. rubens</i> <i>L. scoparius</i> <i>A. tricarinatus</i>
Euphorbiaceae	<i>Euphorbia Palmeri</i>	<i>E. polycarpa</i>
Loasaceae	<i>Mentzelia congesta</i>	<i>M. tricuspis</i>
Onagraceae	<i>Oenothera subacaulis</i>	<i>O. scapoidea</i>
Umbelliferae	<i>Cymopterus terebinthinus</i>	<i>C. panamintensis</i>
Gentianaceae	<i>Swertia albomarginata</i>	<i>S. perennis</i>
Hydrophyllaceae	<i>Phacelia heterophylla</i> <i>Nama Rothrockii</i>	<i>P. calthifolia</i> <i>N. demissum</i>
Boraginaceae	<i>Cryptantha glomeriflora</i>	<i>C. racemosa</i>
Scrophulariaceae	<i>Penstemon Menziesii</i> <i>Castilleja minor</i>	<i>P. ambiguus</i> <i>C. angustifolia</i>
Compositae	<i>Haplopappus eximius</i> <i>Aster integrifolius</i> <i>Erigeron compositus</i> <i>Hemizonia Wheeleri</i> <i>Eriophyllum lanatum</i> <i>Chaenactis nevadensis</i> <i>Artemisia Rothrockii</i>	<i>H. gracilis</i> <i>A. Orcuttii</i> <i>E. Parishii</i> <i>H. Wrightii</i> <i>E. Wallacei</i> <i>C. Fremontii</i> <i>A. spinescens</i>

survive in the desert. Since in both cases the plants are adapted to short growing periods, violent temperature fluctuations and low night temperatures, we might conclude either that genera in strong evolutionary development (with many endemic species) have greater inherent adaptability, or that adaptation to frost resistance is more common than adaptation to drought resistance. Yet the Cactaceae have no alpine representatives; neither have *Agave*, *Fouquieria*, Zygophyllaceae nor other typical desert plants.

It might seem that the plants used by the Carnegie Laboratory group at Stanford University disprove the conclusions reached above. A number of plants with a very wide altitudinal distribution has been investigated (Clausen, Keck and Hiesey, 1940), some of them belonging to boreal genera (*Achillea lanulosa*, *Viola purpurea*, *Aster adscendens*, *Potentilla glandulosa*, *P. gracilis*). These plants, however, are exceptions to the rule and were deliberately selected among the whole vegetation of California because of their exceptionally wide altitudinal and latitudinal distribution. With such exceptions we can say that the great majority of species has a fairly limited range of distribution. This is surprising in view of the fact that the same temperatures occurring in July and August at 3000 meters altitude, occur in May and October at 1500 meters and in February and November at sea level. Therefore a summer plant at high altitudes might grow as a spring or autumn plant at lower altitudes and be subjected to exactly the same temperatures. There are a few plants which behave in this way, like *Erysimum asperum*, which flowers in February at sea level and in July at timberline, but the majority of plants do not shift their growing season, thus enabling them to occur at different altitudes. This is due to other climatic factors such as photoperiod, chilling requirement, and seasonal succession of temperatures. And this brings us back to the original thesis, that the physiological responses to climatic factors are only very little changed in the course of evolution.

SUMMARY

The close relationships of many desert and alpine plants in California is pointed out. This resemblance is greatest for the alpine therophytes (annuals) of which 75 per cent have close relatives in the desert. This is due to several reasons:

- 1) Climatically the desert and alpine habitats are alike during the actual growing season.
- 2) Whereas part of the alpine flora is of circumboreal origin, at least one-half belongs to genera endemic in Western North America, which are exactly those which have also developed representatives in the desert.

When comparing the altitudinal distribution among the alpine plants of the circumboreal genera with those endemic in Western North America, it was concluded that in general the climatic re-

sponse of a genus or a family is only very little affected by evolution. This climatic response is due to physiological characters, such as temperature requirement, frost and drought resistance, and water requirement.

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SOME ADDITIONAL NOTES ON POLEMONIACEAE

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The preparation of the manuscript for the treatment of Polemoniaceae in Abrams, Illustrated Flora of the Pacific States, demands that certain points not suitable to develop in that publication be made clear elsewhere. These are the publications of certain new species and subspecies and the discussions of reasons for some of the decisions made where problems seem controversial. Most of the present notes concern the genus *Linanthus*. A new species of *Collomia* is also included.

LINANTHUS ANDROSACEOUS BENTH.

The treatment afforded this species calls for the aggregation of several entities traditionally regarded as distinct, as subspecies under *L. androsaceus* Benth. This move appears imperative because there seems to be no way to differentiate these subspecies clearly from one another because they show intergradation of a type that suggests wholesale introgression. What appears to have happened is that there developed under the sanction of insular isolation of late Tertiary time a large number of distinct types which, when the continent assumed its present form, were permitted to mingle, apparently without effective genetic barriers between them. The result is the present morphological confusion in the coast ranges of California and Oregon. Where colonies have persisted under conditions of isolation they have retained a certain local uniformity. One such colony occurs in the Sierra Nevada foothills and necessitates formal description as a new subspecies.

LINANTHUS ANDROSACEUS subsp. *laetus* subsp. nov. A typico *L. androsaceo* differt corollis albis, papillis testarum in descriptionibus annularibus corrugatis dispositis.

Differs from typical *L. androsaceus* in the white corolla and in having the papillae of the seed coat in a definite, corrugated pattern around the seed.

Sierra Nevada foothills from Butte County south to Amador County, California. Butte County: Cherokee, altitude 1000 feet, *Mason 12414* (type, Herbarium of the University of California, no. 754224). Eldorado County: near Latrobe, *Mason 7007*; Greene Valley, 4 miles north of Shingle Springs, *Mason 4516*; Pilot Hill, *Mason 7014*; Salmon Falls, *Crum 1027*; Smith Flat, *Robbins 995*. Amador County: Cosumnes River opposite Clark Creek, *Mason 4482*; near Forest Home, Ione to Latrobe highway, *Crum 1690*.

Linanthus Bakeri sp. nov. Herba annua erecta, 6–25 cm. alta; internodia tenues et rigida, foliis 3–7-plo longiore, infra nodis glanduloso-puberulis, pedicellis glanduloso-puberulis; rami cymosi, non profusi; folia segmentis linearibus 3–7-partita; inflorescentia paniculata irregulare, pedicellis tenuibus longis; calyx profunde in segmentis linearibus fissus, ad apicem puberulus, sinus cum membrana hyalina circa semicompleta, per capsulam accrescentem distentu; corolla anguste hypocrateriformis, 6–10 mm. longa, alba, rosacea vel violacea, quandoque zonae definite, tubus exsertus vel raro inclusus, faucium 1–4-plo longiore intus cum linea puberuli vel raro glabri, tubus et fauces vulgo extus puberulo, faucibus angustis, lobis 2–3 mm. longis; stamina in sinibus corollae affixa vel leviter infra, quam lobi $\frac{1}{2}$ longa, filamenta glabra, antherae 1–2-plo longiore; stigma exserta, lobis circa 1 mm. longis; capsula oblongo-cylindrica, semina in quoque locula plures.

Erect slender annual, 6–25 cm. high; internodes wiry, 3–7 times the leaves; glandular puberulent below the nodes and on pedicels; branching cymose, not profuse; leaves 3–7 parted into linear lobes; flowers on long slender pedicels in an irregular cymose panicle; calyx deeply cleft into linear lobes, these puberulent above toward the tips, sinuses about half filled with a narrow hyaline membrane which becomes distended by the growing capsule; corolla slender funnelform, 6–10 mm. long, white, pink, lilac or violet, sometimes with a definite zoning, tube usually exserted, rarely included, 1–4 times the throat, with a narrow hairy band within, rarely glabrous, tube and throat usually puberulent exteriorly, throat narrow, lobe 2–3 mm. long; stamens inserted in the sinuses of corolla lobes or just below, $\frac{1}{2}$ as long as corolla lobes, filaments glabrous, 1–2 times the anthers; stigma exserted from orifice of throat, lobes about 1 mm. long; capsule oblong cylindric, locules several seeded. (*Gilia Bolanderi* of Brand in Engler Pflanzenreich 4²⁵⁰:134. 1907, as to specimens cited. Non Gray.)

Fresno County and Mount Diablo, north in Coast Ranges and Sierra Nevada, California, to Klickitat County, Washington. CALIFORNIA. Pilot Hill, Eldorado County, *H. L. Mason 7015* (type, Herbarium of the University of California, no. 754226); serpentine, Stonyford, Colusa County, *Mason 12404, 12405*; serpentine Stonyford, Colusa County, *Mason 12404, 1205*; serpentine Stonyford, hills, Mount Bullion, Mariposa County, *Mason 11739*; serpentine outcrops, Scott Valley, Siskiyou County, *Horn 45*; Los Molinos, Tehama County, *Wohletz 15*; Watts Valley, Fresno County, *Hoover*; Mendocino Pass, Glenn County, *Howell 19777*; Moon-springs, Bald Mountain, Lassen National Forest, June 8, 1928, *Swift*. OREGON. Sterile ground, Tumolo, Deschutes County, *Peck 19750*; 3 miles above Cave City, May 15, 1935, *Adams*. . .

LINANTHUS BICOLOR subsp. *minimus* subsp. nov. A typico *L. bicolor* differt corollis minutis albis vel sordidis.

Corolla minute, about 1 cm. long, white to sordid.

Coastal area from Bodega Head, California, north to Puget Sound, Washington. Gages Point, Skagit County, Washington, May 8, 1927, *Roush* (type, Herbarium of the University of California, no. 709722). CALIFORNIA. Gasquet, Del Norte County, *Tracy 12361*; Hoopa Mountain, Humboldt County, *Tracy 12576*; Bodega Bay, Sonoma County, *Baker*.

LINANTHUS HARKNESSII subsp. *condensatus* subsp. nov. Caulis pumilis ramosissimus; corolla calycis longiore; stamina subsessile, faucium ad medium inserta.

Low, densely branched; corolla exceeding calyx; stamens subsessile, inserted midway on throat.

Known only from the type locality. Plaskett Meadows, Glenn County, California, *Baker 10593* (type, Herbarium of the University of California, no. 754225), *Howell 19827*.

Linanthus Killipii sp. nov. Herba annua erecta, internodiis infra vulgo congestis supra rigidus, foliis 1-8-plo longiore, ad nodem puberulis vel aliquando floccosis; cotyledones sessiles ovatae anguste perfoliatae; folia palmatim in 5-7 segmentis linearibus 3-10 mm. longis incisa, supra cum capilli albi subtus puberula vel glabra; inflorescentia cymis congestis quisque 3-7-flores; floribus sessilibus; sepalis ad margo conspicue membranaceis praeter ad apicem, membranis infra connatis post anthesin accrescens; corolla 10-15 mm. longa, anguste hypocrateriformis, tubus 4-5 mm. longus, robustus, faucium subaequans vel vix longiore a calyce inclusus vel vix exsertus, fauces angustae subcylindricae, lobis rhomboideis denticulatis vel ad apicem integeribus, basim cum macula linearis; stamina faucium, affixa, filamenta glabra faucium aequans; stylus antherae longiore, lobis circa 1 mm. longis; semina in quoque locula plures ellipsoidea, sub aqua immutata.

Erect annual, branching usually well above the base, the basal

internodes often congested, stems of the upper internodes wiry, 1-8 times the leaves, puberulent to somewhat floccose at the nodes; cotyledons sessile, ovate, narrowly perfoliate; leaves palmately cleft into 5-7 linear segments, 3-10 mm. long, puberulent to glabrate below, hairy above with weak white hairs, the lower somewhat perfoliate; inflorescence of congested cymes at the ends of the branches, each 3-7 flowered; flowers sessile; calyx lobes conspicuously membrane-margined except at the tips, the membranes united below to form the calyx tube and expanding with the growing capsule; corolla 10-15 mm. long narrowly funnel-form, the tube 4-5 mm. long, stout, from subequal to slightly longer than the throat and included or barely exerted from the calyx, throat narrow, subcylindric, that is forming a narrow angle; lobes somewhat rhombic, denticulate or entire at apex and with a linear spot near the base; stamens inserted on the throat near the junction with the tube, filaments glabrous, equaling the throat and with the anthers disposed in its orifice; style slightly exceeding the anthers, the stigma lobes about 1 mm. long; capsule locules several seeded, the valves adhering at the base; seeds ellipsoid, reddish brown, unaffected by wetting.

Upper desert slopes of the San Bernardino Mountains, California. Cactus Flat, altitude 5900 feet. San Bernardino Mountains, June 13, 1941, *Killip 36343* (type, United States National Herbarium 1,828,544); Baldwin Lake, San Bernardino Mountains, *Peirson 6748*.

LINANTHUS NUDATUS GREENE VERSUS *L. NASHIANUS* JEPSON

In treating this species I have accepted the name *L. nudatus* given it by Greene and rejected *L. Nashianus* of Jepson. The bracts subtending the inflorescence of this species are unlike anything found elsewhere in the genus. The lobes are joined to one another by a scarious membrane. In view of the very distinctive nature of the bracts and in view of the fact that Brand illustrated it and saw and cited a specimen labeled "Lake Co." seems conclusive proof that such a specimen existed even though we are unable to locate it at present nor has it been since collected in Lake County. Greene's description fits this species except that he makes no mention of the scarious membrane of the bract. However, the combination of hispidulose-ciliate lower leaves with villous-ciliate bracts and hirsute-ciliate calyx lobes occurs nowhere else in the genus so far as I am aware. The nearest in this respect are *L. ciliatus* and *L. montanus*, both of which were well known to Greene. However, these are hispid-ciliate throughout and neither is either hirsute- or villous-ciliate. Judging from its occurrence in the southern Sierra Nevada it seems improbable but not impossible that it occurs in Lake County. There seems no good reason, however, for rejecting the name *L. nudatus* simply

because of an apparent error in locality on the label and especially since Brand's illustration makes it amply clear what Greene had in mind when he named *L. nudatus*.

LINANTHUS DACTYLOPHYLLUM (TORR.) RYDB. VERSUS
L. DEMISSUS (GRAY) GREENE

Torrey, when calling attention to a plant collected by the Ives Expedition referred to it as being scarcely sufficient for description but he gave a very brief description and listed it as follows: "*GILIA DACTYLOPHYLLUM*, (n. sp.?)." Since the word "*Dactylophyllum*" is the name of a section of the genus, Gray interpreted Torrey as merely indicating the section to which it belonged, a current practice of the time. He then proceeded to name and describe the species based upon more adequate material. Gray's position is further supported by the question mark following the letters "n. sp." which to him meant that Torrey was uncertain about it being new. This led Gray in citing Torrey's name to put a comma between the generic name and the word *Dactylophyllum*. The comma points clearly to the reasons for Gray's action but unfortunately Torrey did not use the comma. The only clues to Torrey's action are the question mark, and the statement as to the inadequacy of the specimen. I am inclined to agree with Gray in his interpretation of the matter. I think that Torrey was meaning only to call attention to the section of the genus to which the plant belonged. I raise the following further arguments to support my contention. 1) The question mark placed where it is, indicates Torrey's uncertainty about the plant being a new species and it is my personal opinion that a question mark associated in any way with a new name should by international agreement be construed to indicate a tentative name. 2) A species named "*dactylophyllum*" would naturally be supposed to be the type species of the section *Dactylophyllum* which this is not. This constitutes a source of confusion. 3) Torrey and Gray were co-authors of the Ives report and it is reasonable to suppose that each was aware of the work and motives of the other. I therefore accept the name *Linanthus demissus* (Gray) Greene.

GILIA TULARENSIS BRAND VERSUS LINANTHUS
OBLANCEOLATUS EASTWOOD EX BRAND

In the year 1904 Culbertson collected specimens of a *Linanthus* in Hockett Meadows, Tulare County, California, which he sent to C. F. Baker. Baker, in turn sent them to Alice Eastwood for identification. She named them *Linanthus ob lanceolatus* n. sp. and this name was appended to the specimens which were distributed by Baker. The name was used as well in Baker's published list, but without description. *Linanthus ob lanceolatus* Eastwood then is a *nomen nudum*. I wish to emphasize the point

that the name *L. oblanceolatus* Eastwood was based upon the Culbertson specimen.

Brand, in 1907, borrowed the Polemoniaceae material from the California Academy of Sciences and found there, in addition to the Culbertson collection, two collections by Hall and Babcock. He gave to one Hall and Babcock collection (no. 5554) the name *Gilia oblanceolatus*, credited the specific name to Eastwood and cited the name *Linanthus oblanceolatus* in synonymy. The Hall and Babcock specimen was used as the type. Then Brand erected the variety *Culbertsoni*, based upon the Culbertson specimen. To the other Hall and Babcock specimen (no. 5211) which had a slightly longer corolla he gave the name *Gilia tularensis*.

In handling this problem we can disregard at the outset the name *Linanthus oblanceolatus* Eastwood as applying to the Culbertson specimen because it was never validly published. The name *Linanthus oblanceolatus* Eastwood ex Brand as applying to the first Hall and Babcock specimen was first published in synonymy with a literature citation that involved the Culbertson specimens. This I construe as invalidating the appellation *oblanceolatus* for use in the genus *Linanthus* and we must turn to the name *Gilia tularensis* for a name for these three collections which I regard to represent the same entity. The new combination and synonymy for *Linanthus tularensis* follow:

Linanthus tularensis (Brand) comb. nov. *Gilia tularensis* Brand in Engler, Pflanzenreich 4²⁵⁰: 136. 1907. *Gilia oblanceolata* (Eastwood) Brand, l.c. *Linanthus oblanceolatus* Eastwood ex Brand in synonymy, l.c. *Gilia oblanceolata* var. *Culbertsoni* Brand (spelled *Cubbertsoni*) l.c.

Collomia Tracyi sp. nov. *C. tinctoria* subvar. *luxuriosa* Brand, in Fedde, Rep. Spec. Nov. 17: 317. 1921. *C. tinctoria* f. *luxuriosa* (Brand) Wherry, Am. Midland Nat. 31: 227. 1944.

Herba annua erecta vel expansa, 5–20 cm. alta; caules bifurcati glandulosi; folia linearia vel lanceolata acuminata petiolata vel subsessilia 2–6 cm. longa; flores 2–5, terminali vel in axillis foliorum vel in furcis ramorum; lobi calycis lanceolati attenuati minute glandulosi; corolla 15–25 mm. longa, calycem 3-plo longiore; stamina valde inaequaliter inserta, infimo in tubo saepe subsessili, summis in faucibus, filamentis longis glabris; stigma inclusa, semina solitaria in loculis.

Erect or spreading annual, 5–20 cm. high; stems forked, glandular; leaves linear to lanceolate, tapered at both ends, petioled or subsessile, 2–6 cm. long, those in the inflorescence barely exceeding the flowers, flowers in clusters of 2–5, terminal on the branches or in the axils of the leaves and forks of the branches, clusters subtended by few leafy bracts; calyx lobes lanceolate attenuate, minutely glandular; corolla 15–25 mm. long, 3 times the calyx, subequal to slightly exceeding the leaves of inflores-

cence, limb about 1 cm. broad, white to pink, tube sometimes purple; stamens very unequally inserted, lowermost well down the corolla tube and often subsessile, the upper on the throat and with long glabrous filaments; stigma included, capsule obovoid, seeds solitary in the locules.

Mountains in the drainage basin of the Van Duzen, Mad, and Klamath rivers of Humboldt and Trinity counties, California, 1000 to 6800 feet. Trinity County: Three Forks of Mad River, *Tracy* 10220 (type, Herbarium of the University of California, no. 754223); head of White's Creek, Devil's Canyon Mountains, *Tracy* 14606; Mary Blaine Mountain, *Tracy* 14466; Upper Mad River, June 26, 1893, *Blankinship*. Humboldt County: Grouse Mountain, *Tracy* 16420, 16670; South Fork Mountain, *Tracy* 9046; Horse Mountain, *Tracy* 8161; Van Duzen River at Dinsmore's, *Tracy* 16373; Trinity Summit, *Tracy* 10468; Van Duzen River near Carlotta, *Baker* 102; Van Duzen River Valley opposite Buck Mountain, *Tracy* 2719, 2720; northwest slope of Buck Mountain, *Tracy* 2837; Klamath River, *Chandler* 1475; Hoopa Mountain, *Davy* and *Blasdale* 5675.

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A NEW SPECIES OF PHACELIA FROM SONORA, MEXICO

LINCOLN CONSTANCE

The only species of *Phacelia* listed by Gentry in his admirable study (1942, p. 219) of the flora and vegetation of the Rio Mayo area of southern Sonora was given as "*Phacelia* cf. *congesta* Hook." He characterized the plant as a spring-blooming winter annual, scattered and infrequent on wooded slopes in the Short-tree Forest at elevations of 800 to 2000 feet. Since Gentry's collections are widely distributed, I have frequently met with specimens of this entity, which I have been guilty of casually annotating as "*P.* aff. *distans* Benth." Now that several sheets of this plant have recently been sent me for verification, I have found it necessary to make a more serious study of it, and have concluded that it is undescribed.

Phacelia Gentryi, sp. nov. Planta annua, basi ramosa, ramis diffusis, 3-6 dm. longis hirsutis hirsutulisque vel hirtellis, inflorescentia stipitato-glandulosa; folia oblongo-ovalia ovalave, 3-7 cm. longa, 2.5 cm. lata, pinnata vel pinnatifida, foliolis crenulatis breviter dentatisve; inflorescentia scorpioidea, cymis solitariis vel geminatis, 10-20-floribus; pedicelli maturi adscendentes, 0.5-1.5 mm. longi; calycis lobae lineari-oblongolatae, 3-5 mm. longae, 0.3-0.8 mm. latae, obtusae, plerumque subaequales, dense hirsutae; corolla pallide coerulea, lati-campanulata, 5-7 mm. longa

lataque, pilosa, lobis obovatis, obscure crenulatis; appendiculæ semiovatae, lamellis ca. 1 mm. longis, partibus transversis appendiculorum prominentibus; stamina corollae subaequalia, ca. 4 mm. longa, antheris ovalibus 0.5–0.7 mm. longis, filamentis glabris; stylus anthesi corollam subequans, maturitate ca. 5 mm. longus, ad $\frac{3}{4}$ longitudinis partitus, sub medio hirsutulus, ovario hirsuto; ovula 2 ad quamque placentam; capsula matura globosa, 1.5–2 mm. longa; semina plerumque 4, oblonga, ca. 1.5 mm. longa, brunnea, alveolata.

Low spreading annual, the branches diffuse, 3–6 dm. long, hirsute with stiff scattered spreading or reflexed hairs and hirsutulous or hirtellous, the inflorescence glandular with stipitate capitate glands; leaves thin, oblong-oval to oval, 3–7 cm. long, 2.5–5 cm. broad, pinnate or pinnatifid, the divisions oblong to oval, 1–3 cm. long, 0.5–1 cm. broad, crenulate to shallowly dentate, sparsely strigose or strigulose; inflorescence scorpioid, of simple or geminate terminal and axillary 10–20 flowered cymes, the mature pedicels ascending, 0.5–1.5 mm. long; calyx lobes linear-oblong, 3–5 mm. long, 0.3–0.8 mm. broad, obtuse, usually subequal, densely spreading-hirsute and often glandular at base; corolla pale blue, broadly campanulate, 5–7 mm. long and broad, the lobes obovate, obscurely crenulate, pilose on the back, the appendages broad, semi-ovate, wholly attached on the side away from the filament, forming a V-shaped pocket at the base of each filament, the lamella about 1 mm. high, the transverse part prominent; stamens about equalling the corolla, ca. 5 mm. long, the anthers oval, 0.5–0.7 mm. long, the filaments glabrous, or nearly so; style included in flower to slightly exserted, when mature ca. 5 mm. long, parted $\frac{3}{4}$ of its length, hirsutulous below the middle, the ovary densely hirsute; ovules 2 to each placenta; mature capsule globose, 1.5–2 mm. long; seeds usually 4, oblong, ca. 1.5 mm. long, brown, alveolate.

Type. San Bernardo, Rio Mayo, Sonora, Mexico, 26 February 1935, *H. S. Gentry 1364* (GH, type; MO). [The symbols used for herbaria are those listed by Lanjouw (1939)]. Other specimens examined. SONORA. Alamos, 28 January 1899, *E. A. Goldman 306* (US), 17 March 1910, *Rose, Standley & Russell 13,014* (US), San Bernardo, 12 February 1935, *Gentry 1304* (MEXU, MO), 26 February 1935, *1364*.

This species is a member of that portion of section *Euphacelia* revised by Voss (1935) under the title of "the *Phacelia hispida* group." Voss did not delimit the group in any way, but he included in it *P. cicutaria* Greene [*P. hispida* A. Gray, non Buckl.], *P. cryptantha* Greene, *P. umbrosa* Greene, and *P. vallis-mortae* Voss; these species all occur substantially to the north of the range of *P. Gentryi*, according to his map. In Voss's key, the new entity would lead (with difficulty) to *P. cryptantha*, from which it differs in its markedly glandular inflorescence, much shorter pedicels

and calyx lobes, broader and differently colored corolla, and differently shaped appendages. It may be distinguished with equal ease from *P. umbrosa*, the third small-flowered member of this alliance, by its glandular inflorescence, shorter and obtuse calyx lobes, broader and differently colored corolla, longer stamens, and much smaller seeds.

It is a pleasure to name this species for Dr. Howard Scott Gentry, now of the Alan Hancock Foundation of the University of Southern California, whose extensive explorations and published accounts have added so much to our knowledge of the fascinating flora of northern Mexico.

Gray Herbarium,
Harvard University

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- LANJOUW. 1939. On the standardization of herbarium abbreviations. Chron. Bot. 5: 142-150.
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CHROMOSOME NUMBER PUBLICATION

J. A. RATTENBURY

It is planned to publish periodically in MADROÑO lists of chromosome numbers of plants comprising species whose chromosome numbers have not appeared to date in other publications, or are at variance with previously given figures. An effort is being made to present these data in a manner conformable both to usefulness and economy of space.

The conscientious taxonomist feels that the identification of the species listed in tabulations such as this is in part the interpretation of the author, and with changing nomenclature is subject to revision. The proposal is, therefore, to restrict publication of chromosome numbers to those collections which are documented by reliable vouchers in the form of herbarium sheets filed in one or preferably more permanent herbaria. It is further recommended that permanent cytological preparations be preserved, either attached to the herbarium sheet or in some other easily accessible form, so that critical counts may be confirmed by interested researchers. Camera lucida drawings from cells in marked regions of the permanent slides may also be attached to the sheets. The desirability of making permanent documentation of the results of research cannot be too strongly stressed.

It is hoped that botanists and geneticists will contribute chromosome counts from time to time. The data should include as much as possible of the information shown in the accompanying table. If the response is sufficiently great, an attempt will be made to group related species, genera and families into the same issue. Undocumented counts will not be published.

The chromosome number listed will be that typical for the tissue from which the count was taken. For example: $2n = 9_{II}$ (metaphase I); $2n = 18$ (somatic cell); $n = 9$ (meiosis II and pollen grain division). The method of making slides permanent described by Bradley [Stain Tech. 23(1): 41-44, 1948] is recommended for the preservation of cytological evidence.

Contributions to this section of MADROÑO may be addressed to the editor.

DOCUMENTED CHROMOSOME NUMBERS OF PLANTS

SPECIES	NUMBER	COUNTED BY	COLLECTION	LOCALITY
CRUCIFERAE				
<i>Cakile</i> <i>edentula</i> (Bigel.) Hook.	$2n = 9_{II}$	A. R. Kruckeberg, Univ. Calif. Berkeley	<i>Kruckeberg</i> 1656 UC ¹	Jenner, Sonoma Co., Calif.
LILIACEAE				
<i>Disporum</i> * <i>Hookeri</i> (Torr.) Britt.	$2n = 9_{II}$	J. A. Rattenbury, Univ. Calif. Berkeley	<i>Rattenbury</i> 96, 104, 111 UC	Contra Costa Co., Calif.
<i>Smilacina</i> * <i>sessilifolia</i> Nutt.	$2n = 18_{II}$	M. S. Cave, Univ. Calif. Berkeley	<i>Rattenbury</i> 94 UC	Contra Costa Co., Calif.
* <i>amplexicaulis</i> Nutt.	$2n = 18_{II}$	J. A. Rattenbury, Univ. Calif. Berkeley	<i>Rattenbury</i> 95, 114 UC	Contra Costa Co., Calif.

* Prepared slide available.

¹ Symbols used for herbaria are those listed by Lanjouw, *Chronica Botanica* 5: 142-150. 1939.

Department of Botany
University of California, Berkeley.

INDEX TO VOLUME IX

For classified items see: Biographical articles, Chromosome numbers, Reviews. New scientific names are printed in bold-face type.

- Actinocyclus, 65
 Aegilops Hystrix, 125
 Agropyron, 122: arenicola, 127; arizonicum, 125; dasystachum, 127; Gmelini var. Pringlei, 125; junceum, 126; laeve, 126; latiglume, 200; Parishii, 126, var. laeve, 126; pauciflorum, 126; Pringlei, 125; repens, 127; riparium, 127; Saundersii, 125; saxicola, 125; Smithii, 127, var. riparium, 127; spicatum, 125, var. arizonicum, 125; subsecundum, 126; tenerum, 126
 Algae: Generic names of, proposed for conservation. I, 8; Notes on Pacific Coast marine, 155
 Aliciella triodon, 214
 Allium: anceps var. aberrans, 238; Brandegei, 234; Cusickii, 237; Douglasii, 233, var. Tolmiei, 237; idahoense, 237; parvum, 236; platyphyllum, 238; pleianthum, 237; Tolmiei, 237; Tolmiei Baker, The identity and delimitation of, 233; tribracteatum, 234
 Alpine flora in California, Some parallels between desert and, 241
 Alpine tundra, 143
 Amelia, 65
 Amphisiphonia pacifica, 155
 Anemone: globosa, 6; parviflora, 5
 Anisocladella pacifica, 158
 Annulina, 8
 Antennaria pulvinata subsp. albescens, 8
 Aphelandra: Goodspeedii, 154, pl. 153; ornata, 154; Seibertii, 154
 Aquilegia formosa var. flavescens, 6
 Arabis hirsuta var. pycnocarpa, 6
 Aragalus viscidula, 7
 Arenaria: propinqua, 5; Rossii, 5
 Asperella: 122; californica, 127
 Astragalus: alpinus, 6; impensus, 6; Purshii, 6
 Atelophragma alpiniformis, 6
 Auricularia tremelloides, 9
 Baker, M. S., A new violet from Mexico, 131
 Barkley, F. A. and P. C. Standley: Noteworthy South American plants, I and II, 149
 Batrachospermum, 8
 Beloperone: cochabambense, 154; Soukupii, 152, pl. 151
 Betula glandulosa, 5
 Binghamiella Forkii, 158
 Biographical articles: Jepson, W. L., 61, 223; Komarov, V. L., 57
 Blennosperma: A new species of, from California, 103; Bakeri, 103, fig., 103; californicum, 104, fig., 103; chilense, 104; nanum, 104
 Botrychium virginianum, 3
 Cakile edentula, 258
 Calamagrostis neglecta, 4
 California: Elymus aristatus in, 232; A new species of Blennosperma from, 103
 Callithamnion Pikeanum var. pacificum, 158
 Carex: capillaris, 4, var. elongata, 4; concinna, 4; disperma, 4; gynocrates, 4; leptalea, 4; pseudoscirpoidea, 4; VahlII, 4
 Castilleja wallowensis, 7
 Catenella, 12: Opuntia, 12; repens, 12
 Ceramium: gracillimum, 158; procumbens, 158; sinicola var. interruptum, 158; transversale, 158
 Ceramiaceae, 14
 Champia, 10
 Champiaceae, 13, 14
 Chantransia, 8: nigricans, 9; nodosa, 9; vesicata, 9
 Cheirinia desertorum, 64
 Chimaphila, 65, 67, 97: japonica, 67, 98; maculata, 67, 70, 98; Menziesii, 67, 70, 98, figs. 69, 73, 75, 79, 83, 85, 93; umbellata, 67, 70, 98, figs. 83, 85, 93
 Chlorophyceae, 155
 Chlorophycophyta, 8
 Chondria, 10, 11, 15: tenuissima, 15
 Chordaria: divaricata, 10; flagelliformis, 10
 Choreocolax Polysiphoniae, 159
 Choreonema Thureti, 157
 Chromosome numbers: Blennosperma Bakeri, 104, californicum, 104; Cakile edentula, 258; Disporum Hookeri, 258; Smilacina amplexicaulis, 258, sessilifolia, 258
 Chromosome number publication, 257
 Chylocladia, 10, 11: kaliformis, 11; verticillata, 11
 Cladophora, 8: glomerata, 8
 Cladophoraceae, 8
 Clavaria, 12
 Clavatula, 12

- Cleome: Eyerdamii*, 150, pl., 151;
psoraleaeifolia, 150
Clinelymus, 122; *glaucus*, 126
Coahuila: Mexico, Vegetation and climate of, 33; *Vegetation of*, pls., 45, 47, 49, 51, 53
Codium fragile, 156
Collinsia californica, 13
Collomia, 207; *glutinosa*, 207; *tinctoria f. luxuriosa*, 254; *Tracyi*, 254
Colorado, Range extensions of grasses into, 199
Condalia: Two new varieties of, from Texas, 128; *lycioides*, 130; *obovata var. edwardsiana*, 128; *obtusifolia*, 130; *viridis var. Reedii*, 129
Conferva, 10; *albida*, 8; *compacta*, 8; *glomerata*, 8; *nigricans*, 8; *nodosa*, 9; *rivularis*, 8; *rupestris*, 8; *sordida*, 8
Constance, Lincoln, A new species of Phacelia from Sonora, 255
Copeland, H. F.: Observations on the structure and classification of the Pyroleae, 65
Corallorrhiza trifida, 5
Cornea, 12; *capillacea*, 12; *deformis*, 12; *filicina*, 12; *pusilla*, 12; *sericea*, 12; *spinosa*, 12
Cory, V. L.: Old world plants apparently recently introduced into Texas, 64; *Two new varieties of Condalia from Texas*, 128
Cruoria pacifica, 157
Cryptantha celosioides, 7
Cystoseira osmundacea, 157

Dasyopsis densa, 159
Dasyphila, 11, 14; *Preisii*, 14
Dasyphylla, 13, 14, 15; *articulata*, 13; *ovalis*, 14; *sedoides*, 14; *tenuissima*, 15; *Woodwardii*, 15
Davidson, J. F.: A new Polemonium from Mexico, 187; *The polygonal graph for simultaneous portrayal of several variables in population analysis*, 105; *The present status of the genus Polemoniella Heller*, 58
Desert and alpine flora in California, Some parallels between, 241
Desmarestia, 13
Detling, L. E.: Concentration of environmental extremes as the basis for vegetation areas, 169; *Environmental extremes and endemism*, 137
Diacalpe manchuriensis, 191
Dictyopteris Johnstoni, 156
Dictyotaceae, 9
Dilsea, 13

Disporum Hookeri, 258
Dodecatheon alpinum, 7
Dryas Drummondii, 6
Draba: nivalis var. elongata, 6; *praealta*, 6

Ectocarpus: chantransioides, 156; *cy-lindricus*, 156, f. *codiophilus*, 156
Elymus 122; *Nomenclatorial changes in*, with a key to the Californian species, 120; *arenicolus*, 127; *aristatus*, 124, 126, in California, 232; *arizonicus*, 123, 125; *californicus*, 122, 127; *caput-medusae*, 122, 125; *cinereus*, 124, 127; *condensatus*, 124, 127, f. *pubens*, 127; *dasy-stachys*, 127; *elymoides*, 123, 125; *glaucus*, 123, 126; *aristatus*, 126, f. *Jepsonii*, 126, subsp. *Jepsonii*, 122, 126, var. *Jepsonii*, 126, subsp. *vi-rescens*, 124, 126; *Hansenii*, 123, 124, 125; *Hystrix*, 125; *jubatus*, 125; *junceus*, 126; *Macounii*, 123, 126; *mollis*, 124, 126; *multinodus*, 124, 126; *multisetus*, 123, 125; *Orcuttianus*, 127; *pacificus*, 125, 127; *Parishii*, 126; *pauciflorus*, 124, 126, subsp. *laeve*, 123, 126, subsp. *subsecundus*, 123, 126; *Pringlei*, 125; *repens*, 124, 127; *riparius*, 124, 127; *Saundersii*, 123, 125, var. *californicus*, 125; *saxicolus*, 123, 125; *sibiricus*, 122; *sierrus*, 123, 125; *simplex*, 127; *Sitanion*, 125; *Smithii*, 125, 127; *spicatus*, 123, 125; *Stebbinsii*, 123, 124, 126; *subvillosus*, 124, 127; *triticoideus*, 124, 125, 127, subsp. *multiflorus*, 124, 127; *van-couverensis*, 124, 126; *vi-rescens*, 126
Endemism, Environmental extremes and, 137
Environmental extremes: and endemism, 137; *Concentration of*, as the basis for vegetation areas, 169
Equisetum variegatum, 3
Eriogonum Kingii, 5
Erxlebenia, 65, 68, 94, 96
Erysimum repandum, 64
Erythrocladia: irregularis, 156; *sub-integra*, 156
Erythrotrichia pulvinata, 156

Faucha media, 158
Fertilization and maturation of the gametes in Nicotiana, 110
Festuca spicata, 125
Fucus, 10; *Asplenioides*, 14; *cordatus*, 13; *edulis*, 13; *kaliformis*, 11; *Nemalion*, 12; *pectinatus*, 14; *plumosus*, 14; *verticillatus*, 11

- Gametes, Maturation of the, and fertilization in *Nicotiana*, 110
- Gardneriella tubifera*, 157
- Gastroclonium*, 10, 11, 14; ovale, 11; ovatum, 11, 14
- Gelidiaceae, 12
- Gelidium*, 11, 12: *corneum*, 12
- Generic names of algae proposed for conservation. I, 8
- Gentiana interrupta*, 7
- Gentry, H. S.: The genus *Mimulus* in or adjacent to Sinaloa, Mexico, 21
- Germination of *Phacelia* seeds, 17
- Gigartina papillata*, 157
- Gigartinaceae, 12
- Gilia*, 203: Some problems in the genus, 201; subgen. *Campanulastrum*, 219; subgenus *Eugilia*, leaf types, figs., 211; subgen. *Gilmania*, 205; subgen. *Greenianthus*, 206; subgen. *Kelloggia*, 219; subgen. *Tintinabulum*, 220; *Abramsii*, 216, subsp. *integrifolia*, 216; *abrotanifolia*, 208; *achilleaefolia*, 208, subsp. *chamissonis*, 208; subsp. *staminea*, 208; *aggregata*, 206; *arenaria*, 217, var. *Abramsii*, 216; var. *rubella*, 214; *Bolanderi*, 250; *campanulata*, 219; *capillaris*, 219; *capitata*, 208; *caruifolia*, 213; *chamissonis*, 208; *congesta*, 206; *depressa*, 206; *diffusa*, 209; *divaricata* var. *volcanica*, 207; *filiformis*, 220, 246; *gilioides*, 206, subsp. *glutinosa*, 207, subsp. *Volcanica*, 207; *Gilmani*, 205; *Grinnellii*, 213; *Hutchinsifolia*, 214; *inconspicua*, 212; *dentiflora*, 214, subsp. *sinuata* var. *oreophila* subvar. *diffusa*, 209; *inyoensis*, 219; *latiflora*, 218, subsp. *cana*, 218; var. *cana*, 218, subsp. *exilis*, 219, var. *exilis*, 219, subsp. *leptantha*, 219, subsp. *Purpusii*, 218, subsp. *speciosa*, 218, subsp. *triceps*, 219; *latifolia*, 205, 246; *leptalea*, 219, subsp. *bicolor*, 220, subsp. *pinnatisecta*, 220; *leptantha*, 219; *leptomeria*, 214, 216, subsp. *micromeria*, 214, var. *myriacantha*, 214, subsp. *rubella*, 214, var. *tridentata*, 214; *micromeria*, 214; *millefoliata*, 209; *minutiflora*, 219; *multicaulis*, 208; subsp. *eumulticaulis*, 208, var. *millefolia*, 209, subsp. *millefoliata*, 209, subsp. *Nevinii*, 209, subsp. *peduncularis*, 209; *Nevinii*, 209; *oblanceolatus*, 254, var. *Culbertsoni*, 254; *ochroleuca*, 214, 216, 246, subsp. *transmontana*, 215, subsp. *typica*, 215; *peduncularis*, 209; *polycladon*, 206; *Ripleyi*, 205; *rubra*, 206; *scopulorum*, 213; *sinuata*, 215, 216; *splendens*, 210, subsp. *australis*, 213, subsp. *Grinnellii*, 213; *staminea*, 208; *stellata*, 213; *stricta*, 208; *tenerrima*, 220; *tenuiflora*, 217, var. *altissima*, 212, subsp. *interior*, 217, var. *Newloniana*, 213, var. *Purpusii*, 218, var. *speciosa*, 218, var. *triceps*, 219; *Traskeae*, 207; *tricolor*, 209, subsp. *diffusa*, 209, var. *longipedicellata*, 209; *triadon*, 214; *tularensis*, 253, 254
- Glyceria Otisii*, 3
- Goniotrichum cornu-cervi*, 156
- Goodspeed, T. H.: Maturation of the gametes and fertilization in *Nicotiana*, 110
- Gould, F. W.: *Elymus aristatus* in California, 232; Nomenclatorial changes in *Elymus* with a key to the Californian species, 120
- Grant, A. D. and H. L. Mason: Some problems in the genus *Gilia*, 201
- Grasses, Range extensions of, into Colorado, 199
- Grateloupia abbreviata*, 157
- Gymnosorus*, 10
- Gymnostichum californicum*, 127
- Gymnothamnion elegans*, 158
- Habenaria obtusata*, 5
- Harrington, H. D.: Range extensions of grasses into Colorado, 199
- Hedysarum boreale*, 7
- Heiser, C. B., Jr.: A new species of *Blennosperma* from California, 103; Notes on the genus *Townsendia* in Western North America, 238
- Helianthella*: The genus, in Oregon, 186; *californica* var. *nevadensis*, 186, 187; *Douglasii*, 186; *nevadensis*, 186; *quinquenervis*, 186, 187; *uniflora*, 186, 187, var. *Douglasii*, 186, 187
- Helianthus*: *quinquenervis*, 186; *uniflorus*, 186
- Helminthocladiaceae, 11
- Helminthora, 11, 12: *divaricata*, 11
- Herposiphonia*: *secunda*, 160; *tenella*, 159
- Hollenberg, G. J.: Notes on Pacific Coast marine algae, 155
- Hypnea californica*, 157
- Hypopitys*, 95
- Hystrix*, 122: *californica*, 127
- Iridaea*, 11, 12: *cordata*, 13

- Iridea, 12
 Iridophycus, 13
 Isenberg, I. H., Location of extraneous materials in redwood, 25
 Jepson, Willis Linn: biographical sketch of, 61, pl., 63; The place of, in California botany, 223
 Juncus Regelii, 4
 Kaliformia, 11, 12: diaphana, 11; Opuntia, 12; pusilla, 12; verticillata, 11
 Kaliformis, 12, 13, 15: articulatus, 13; dasyphyllus, 15; obtusus, 15; Opuntia, 12; verticillatus, 11
 Kearney, T. H., Review: The evolution of Gossypium and the differentiation of the cultivated cottons, 228
 Keck, D. D.: The place of Willis Linn Jepson in California botany, 223
 Keck, D. D., Review: The New World Cypresses, 229
 Kobresia simpliciuscula, 4
 Komarov, Vladimir L., biographical sketch, 57
 Laurencia, 10, 11, 15: diegoensis, 160; obtusa, 15
 Ledum, 95
 Lemanea, 8
 Lepidium: Davisii, 164, pl., 163; nanum, 162
 Lepidiums, two perennial caespitose, of western North America, 162
 Lesquerella Sherwoodii, 6
 Linanthus: androsaceus, 249, subsp. laetus, 250; Bakeri, 250; bicolor subsp. minimus, 251; ciliatus, 252; dactylophyllum, 253; demissus, 253; Harknessii subsp. condensatus, 251; maculatus, 246; montanus, 252; Nashianus, 252; nudatus, 252; Killipii, 251; Parryae, 246; oblanceolatus, 253; tularenensis, 254
 Lomentaria, 13: articulata, 11, 13
 Lophosiphonia villum, 159
 Mason, H. L., Some additional notes on Polemoniaceae, 249; Willis Linn Jepson, 61
 Mason, H. L. and A. D. Grant: Some problems in the genus Gilia, 201
 Matteuccia, 192: intermedia, 192; japonica, 192; orientale, 193
 Matthews, O. V.: A possible record of Quercus Morehus in Oregon, 168
 Mazzaella, 13
 McMinn, H. E. Review: The Pacific Coast Ranges, 30
 Mexico: The genus Mimulus in or adjacent to Sinaloa, 21; A new Polemonium from, 187; A new violet from, 131; Vegetation and climate of Coahuila, 33
 Microsteris, 207
 Mimulus: in or adjacent to Sinaloa, Mexico, 21; calciphilus, 21; dentilobus, 21, 22; floribundus, 21, 23; glabratus, 21, 23; guttatus, 21, 23; mohavensis, 246; Nelsoni, 21, 23; pallens, 21, 23; Pennellii, 21, 24; verbenaceus, 21, 25
 Mirov, N. T.: Vladimir L. Komarov, 57
 Monezes, 65, 67, 100: reticulata, 100; uniflora, 67, 70, 100, figs., 79, 83, 85, 91, 93
 Muenscher, W. C.: Potamogeton latifolius in Texas, 220
 Muhlenbergia andina, 4
 Muller, C. H.: Vegetation and climate of Coahuila, Mexico, 33
 Nemalion, 11, 12: helminthoides, 12; lubricum, 12
 Nicotiana: Maturation of the gametes and fertilization in, 110, pl., opp. 114; Megasporogenesis and embryo sac formation in, pl., opp. 112; alata, fig., opp. 112; longiflora, figs., opp. 114; otophora, figs., opp. 114; rotundifolia, fig. opp. 112; tabacum, figs., opp. 112, opp. 114
 Nomenclatorial changes in Elymus with a key to the Californian species, 120
 Notes and news, 64, 168, 199, 232
 Oedogonium, 8: vesicatum, 9
 Onoclea: orientalis, 193; sensibilis, 191
 Oregon: Certain plant species of the canyon of Hurricane Creek, Walla Walla County, 1; The genus Helianthella in, 186; A possible record of Quercus Morehus in, 168
 Osmundea, 15
 Ownbey, M. The identity and delimitation of Allium Tolmiei Baker, 233; Review: The Genus Crepis, 165
 Oxytropis: A new species of, from the Central Rocky Mountains, 133; Cusickii, 7; Lambertii, 134; obnapiformis, 133, fig., 134; viscida, 7
 Papenfuss, G. F.: Generic names of algae proposed for conservation, I., 8
 Peck, M. E.: Certain plant species of

- the canyon of Hurricane Creek, Wallowa County, Oregon, 1
- Penstemon Wilcoxii*, 7
- Pentarhizidium*, 191: *intermedium*, 192; *japonicum*, 192; *orientale*, 191, 193
- Petrocelis franciscana*, 157
- Petunia*, 115, 116, 117
- Phacelia*: *alpina*, 18; *cicutaria*, 256; *compacta*, 18; *cryptantha*, 256; *dasyphylla*, 18; *distans*, 18; *Gentryi*, 255; *hispida*, 256; *Lemmonii*, 18; *leucophylla*, 18; *mutabilis*, 18, 19; A new species of, from Sonora, 255; *Quickii*, 18; seeds, germination of, 17; *umbrosa*, 256; *vallicola*, 18; *vallis-mortae*, 256
- Phaeophyceae, 156
- Phaeophycophyta, 9
- Phorandendron*: *Mathewsii*, 150; *semiteres*, 150; *Storkii*, 149, pl., 153
- Physematum manchuriense*, 191
- Pinguicula vulgaris*, 7
- Pinnatifida*, 15
- Pinus flexilis*, 3
- Pirola*, 66: *alba*, 67; *alpina*, 66; *americana*, 67; *aphylla*, 66; *asarifolia*, 67; *atropurpurea*, 66; *blanda*, 67; *bracteata*, 67; *chlorantha*, 66; *Conardiana*, 67; *Corbieri*, 67; *coreana*, 68; *decorata*, 67; *elliptica*, 66; *Faurieana*, 67; *Forrestiana*, 67; *gracilis*, 66; *japonica*, 67; *media*, 67; *minor*, 66; *morrisoniana*, 66; *nephrophylla*, 67; *oxypetal*, 67; *paradoxa*, 67; *renifolia*, 66; *rotundifolia*, 67; *Sartorii*, 67; *septentrionalis*, 67; *soldanellifolia*, 66; *sororia*, 67; *spatulata*, 66; *subaphylla*, 67; *sumatrana*, 68; *uliginosa*, 67
- Pirolaceae, 66
- Plumaria*, 11, 14: *elegans*, 14; *pectinata*, 14
- Poa alpina*, 3
- Pocockiella variegata*, 10
- Pogonophora californica*, 159
- Polemoniaceae, Some additional notes on, 249
- Polemoniella* Heller, The present status of the genus, 58
- Polemoniella*: *antarcticum*, 58; *Gay-anum*, 58; *micrantha*, 58
- Polemonium*, 58: A new, from Mexico, 187; *caeruleum*, 60; *carneum*, 59; *confertum*, 59; *foliosissimum*, 60; *glabrum*, 187, 189, pl., 188; *Lemmonii*, 59; *mexicanum*, 189; *occidentale*, 59; *pauciflorum*, 59, 60, 189; *pulcherrimum*, 59, 60
- Polygonum*: *argyrocoleon*, 64; *viviparum*, 5
- Polysiphonia*: *Eastwoodae*, 160; *Snyderae*, 160, var. *intricata*, 160
- Population analysis, The polygonal graph for a simultaneous portrayal of several variables in, 105
- Porter, C. L.: A new species of *Oxytropis* from the central Rocky Mountains, 133
- Potamogeton*: *latifolius*, 221, pl., 222, in Texas, 220; *pectinatus* var. *latifolius*, 221
- Protowoodsia*, 190: Notes on the taxonomy of some eastern Asiatic ferns of the genera *Pteritis* and, 189; *manchuriensis*, 190
- Psittacanthus*: *cuneifolius*, 152; *Hortonii*, 150, pl., 151
- Pteritis*, 192: Notes on the taxonomy of some eastern Asiatic ferns of the genera *Protowoodsia* and, 189; *intermedia*, 192; *japonica*, 192, 193; *nodulosa*, 192; *orientalis*, 192, 193; *Struthiopteris*, 192
- Pterilis*, 192
- Pterinodes*, 192
- Pterocladia*, 11, 12: *lucida*, 12
- Pterosiphonia*: *Baileyi*, 159; *californica*, 160; *dendroidea*, 159
- Ptilota*, 14: *Asplenoides*, 14; *filicina*, 158; *plumosa*, 14, var. *Asplenoides*, 14
- Pyrola*, 65, 98: *americana*, 99, figs., 79; *aphylla*, 99; *asarifolia*, 99; *bracteata*, 70, 99; *chlorantha*, 7, 99; *dentata*, 70, 99; var. *apophylla*, 70, var. *integra*, 70; *elata*, 99; *elliptica*, 99; *incarnata*, 99; *maculata*, 65; *media*, 99; *minor*, 7, 65, 70, 99, figs., 79, 85, 87, 93; *picta*, 70, 99, figs., 69, 75, 83, 85; *renifolia*, 99; *rotundifolia*, 65, 99; *secunda*, 65; *uliginosa*, 70, 99; *umbellata*, 65; *uniflora*, 65; *virens*, 70, 99
- Pyroleae, 97: Observations on the structure and classification of the, 65; Structure of, pls., 69, 73, 75, 79, 83, 85, 87, 91, 93
- Quercus* Morehus, A possible record of, in Oregon, 168
- Quick, C. R.: Germination of *Phacelia* seeds, 17
- Ramischia*, 65, 66, 97: *secunda*, 66, 97, figs., 75, 79, 83, 85, 93; *secundiflora*, 97; *truncata*, 66, 97
- Rattenbury, J. A.: Chromosome number publication, 257

- Redwood, Location of extraneous materials in, 25
- Reed, C. F.: Notes on the taxonomy of some eastern Asiatic ferns of the genera *Protowoodsia* and *Pteritis*, 189
- Reviews: Babcock, The genus *Crepis*, 165; Hutchinson, Silow, and Stephens, The evolution of *Gossypium* and the differentiation of the cultivated cottons, 228; Martinez, Los *Juniperus Mexicanos*, 135; Peattie, The Pacific Coast Ranges, 30; Stern, A study of the genus *Paeonia*, 193; Wolf and Wagener, The New World Cyprresses, 229
- Rhabdoniaceae, 12
- Rhamnus obtusifolia*, 130
- Rhizoclonium riparium*, 155
- Rhododendron*, 95: *occidentale*, 176
- Rhododermis elegans*, 157
- Rhodoglossum parvum*, 157
- Rhodomelaceae, 15
- Rhodophyceae, 156
- Rhodophycophyta, 10
- Rivularia multifida*, 11
- Rollins, R. C.: On two perennial caespitose lepidiums of western North America, 162
- Salix brachycarpa* var. *Sansoni*, 5; *vestita*, 5; *Wolfii* var. *idahoensis*, 5
- Saxifraga oppositifolia*, 6
- Sedoidea, 11, 14: *olivacea*, 11; *purpurea*, 11
- Senecio vulgaris*, 64
- Sequoia sempervirens*, 25, pls., 28, 29
- Silene acaulis* var. *subcaulescens*, 5
- Sisyrinchium idahoense*, 4
- Sitanion, 122: *elymoides*, 125; *flexuosum*, 125; *Hansenii*, 125; *Hystrix*, 125; *jubatum*, 125; *lanceolatum*, 125; *multisetum*, 125
- Smilacina amplexicaulis*, 258; *sesilifolia*, 258
- Solidago ciliosa*, 7
- Sonora, A new species of *Phacelia* from, 255
- South American plants, Noteworthy, 149
- Sphaerotrichia*, 10
- Standley, P. C. and F. A. Barkley: Noteworthy South American plants, I and II, 149
- Stebbins, G. L., Jr., Review: A study of the genus *Paeonia*, 193
- Stromatocarpus Gardneri*, 159
- Struthiopteris*, 192: *orientalis*, 193
- Swainsona salsula*, 64
- Swertia perennis*, 7
- Terellia Macounii*, 126
- Texas: Old world plants apparently recently introduced into, 64; *Potamogeton latifolius* in, 220; Two new varieties of *Condalia* from, 128
- Thalictrum alpinum*, 5
- Thelaia*, 65: *spatulata*, 99
- Townsendia*: *diversa*, 238; *anomala*, 240; *arizonica*, 239; *florifer*, 239, 240; *incana*, 238; *minima*, 238; Notes on the genus, in Western North America, 238; *scapigera*, 239; *sericea*, 238; *spatulata*, 239; *strigosa*, 240; *Watsoni*, 238
- Triticum*, 120: *dasystachum*, 127; *juncum*, 126; *pauciflorum*, 126; *repens*, 127, var. *dasystachum*, 127, var. *subvillosum*, 127; *Richardsoni*, 126; *subsecundus*, 126; *trachycaulum*, 126
- Ulva, 10
- Ulvella Setchellii*, 155
- Urospora, 8
- Vegetation and climate of Coahuila, Mexico, 33
- Vegetation areas, Concentration of environmental extremes as the basis for, 169
- Veronica Cusickii*, 7
- Villania*, 9, 10
- Viola*: *flagelliformis*, 132; *galeanaensis*, 131, 132, *pedunculata*, 132
- Violet, A new, from Mexico, 131
- Weber, W. A.: The genus *Helianthella* in Oregon, 186
- Went, F. W.: Some parallels between desert and alpine flora in California, 241
- Wiggins, I. L., Review: Los *Juniperus Mexicanos*, 135
- Woodsia*: *alpina*, 191; *cathcartiana*, 191; *crenata*, 191; *elongata*, 191; *fragilis*, 191; *glabella*, 191; *ilvensis*, 191; *insularis*, 191; *lanosa*, 191; *macrospora*, 191; *manchuriensis*, 190; *mexicana*, 191; *mollis*, 191; *montevidensis*, 191; *obtusifolia*, 191; *oregana*, 191; *peruviana*, 191; *Plummerae*, 191; *polystichoides*, 191; *scopulina*, 191; *subcordata*, 191
- Zizyphus*: *lycioides*, 130; *obtusifolia*, 130
- Zonaria, 9: *Pavonia*, 9; *squamaria*, 9; *Tournefortii*, 9; *variegata*, 10

FUMIG 54